

# PATENT ABSTRACTS OF JAPAN

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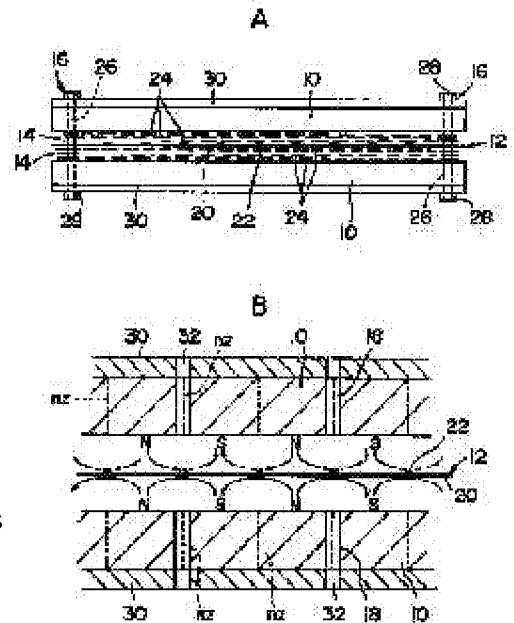
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## (54) THIN PROFILE ELECTROMAGNETIC TRANSDUCER

(57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a large amplitude by suppressing production of abnormal tone (noise) due to resonance of a diaphragm at its circumferential part so as to attain free vibration of the diaphragm locally and entirely, to attain ease of manufacture of the transducer and ease of thin profile.

**SOLUTION:** The transducer is provided with a permanent magnet board 10, a diaphragm 12 opposite thereto, a cushion member 14 interposed between them, and a support member 16 to restrict the position of the diaphragm 12 with respect to the permanent magnet board 10. The permanent magnet board 10 has multi-pole magnetizing patterns in parallel stripes and has an integral structure where exhaust throughholes 18 are arranged to a neutral zone. The diaphragm 12 is structured so that a coil 22 is print-wired to a thin and flexible resin film 20, a straight line part of the coil 22 is provided to a position corresponding to the neutral zone of the permanent magnet board 10 and the diaphragm 12 is supported so as to be freely displaced in the broadwise direction entirely. A buffer member 14 is so structured that a plurality of soft and porous sheets whose size is nearly equal to the size of the diaphragm 12 are stacked.



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## CLAIMS

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[Claim(s)]

[Claim 1]A thin electromagnetic transducer characterized by a thing characterized by comprising the following currently allocated like.

A permanent magnet plate.

Vibrating membrane arranged so that this permanent magnet plate may be countered.

A buffer member which intervenes between this vibrating membrane and said permanent magnet plate.

Provide a support member which regulates a relative position to a permanent magnet plate of said vibrating membrane, and said permanent magnet plate, Parallel stripes-like multi-electrode magnetizing patterns in which a band-like n pole and the south pole appear by turns are formed almost in the whole surface of the vibrating membrane opposed face, And make integral construction which arranged many through holes for exhaust air in a position of a neutral zone in magnetizing patterns, and in it said vibrating membrane, It is the structure which carried out the printed wiring of the coil which becomes a thin flexible resin film from conductor patterns of meandering shape, Although a straight-line portion of these conductor patterns is provided in a position corresponding to a neutral zone of said permanent magnet plate and displacement of field inboard is regulated by said support member, without being fixed in a periphery, Structure which said buffer member is elasticity, and has breathability, and accumulated two or more sheets of the almost same size as said vibrating membrane is made by being supported by thickness direction so that it can be displaced freely, and it is a crevice between this sheet, said permanent magnet plate, or vibrating membrane.

[Claim 2]The thin electromagnetic transducer according to claim 1 currently fixed by opening an interval by physical relationship that a permanent magnet plate and a buffer member are arranged to both sides of this vibrating membrane, respectively so that vibrating membrane may be pinched, each neutral zone of permanent magnet plates [ both ] corresponds, and like poles face each other.

[Claim 3]The thin electromagnetic transducer according to claim 2 using vibrating membrane in which conductor patterns of meandering shape were formed to both sides of a resin film.

[Claim 4]With a vibrating membrane opposed face of a permanent magnet plate, a high-magnetic-permeability magnetic plate for prevention from a magnetic flux leak is stuck to a field of an opposite hand, The thin electromagnetic transducer according to claim 1 to 3 formed so that a through hole for exhaust air of a permanent magnet plate and a through hole for exhaust air of a high-magnetic-permeability magnetic plate might open for free passage a through hole for exhaust air formed in a permanent magnet plate, and many

same through holes for exhaust air of each other also to this high-magnetic-permeability magnetic plate.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]The permanent magnet plate which gave multi-electrode magnetization of integral construction when this invention was described in more detail about the electromagnetic transducer of thin structure, It is related with the thin electromagnetic transducer which has a buffer member which intervenes between the vibrating membrane which has a meandering coil pattern arranged so that an interval may be set to it and it may be countered, and this permanent magnet and vibrating membrane. This thin electromagnetic transducer is useful to a monotonous loudspeaker, headphone, or a microphone, for example.

[0002]

[Description of the Prior Art]The electromagnetic transducer of the flat sheet structure which combined a permanent magnet and vibrating membrane is conventionally publicly known. This kind of electromagnetic transducer usually possesses permanent magnet structure, the vibrating membrane arranged so that that permanent magnet may be countered, and the support member which fixes vibrating membrane by a periphery to permanent magnet structure.

[0003]The permanent magnet structure used for this conventional kind of electromagnetic transducer here is the composition which arranged the cylindrical permanent magnet of the book so that \*\*\*\*s might differ by turns in parallel, and carried out [ many ] connect fixing mutually by the nonmagnetic structural member of having given double-sided 2 pole magnetization (magnetization of the sliding direction of a structure). The thing in which the coil which becomes the thin surface or inside of a resin film from the conductor patterns of meandering shape was formed is used for vibrating membrane. And many straight-line portions of the conductor patterns of the meandering shape combine this vibrating membrane with permanent magnet structure by physical relationship which corresponds to the middle portion of the cylindrical permanent magnets arranged by parallel exactly. Actually, it has composition fixed to permanent magnet structure via a spacer by the periphery of vibrating membrane.

[0004]A line of magnetic force passes between the magnetic poles of an adjacent cylindrical permanent magnet, and a magnetic field which crosses the straight-line portion of the conductor patterns of vibrating membrane arises. Then, when it energizes in the coil of vibrating membrane, the electromagnetic force according to the left-hand rule of Fleming will arise, and vibrating membrane will be displaced to a thickness direction. By this principle, the vibration corresponding to the driving current to the coil arises, and a sound wave occurs. A sound wave is emitted outside through between cylindrical permanent magnets.

[0005]

[Problem(s) to be Solved by the Invention]In the conventional permanent magnet structure, in order to raise the performance, it is desirable to allocate a long and slender cylindrical permanent magnet as densely as possible. However, as it is going to carry out to the permanent magnet used, for example being a sintered magnet (ferrite magnet) at long and slender shape, the thing to which manufacturing with high degree of accuracy becomes difficult (modification of curvature etc. arises at the time of calcination) and for which it carries out and sufficient mechanical strength is given becomes more difficult. Since big magnetic force acts each other among cylindrical permanent magnets, the work in which it is very difficult to make a long and slender cylindrical permanent magnet approach mutually, and to assemble it correctly is required. Since each cylindrical permanent magnet will be dissociated mutually, a magnetic pole appears not only in both sides of a thickness direction but in the edge part of the upper and lower sides and the side and the part of the side, Magnetic flux (it is linearly in the portion of a crevice) will fly to a transverse direction between the approaching cylindrical permanent magnets, the number of the lines of magnetic force interlinked with the coil (straight-line portion of conductor patterns) of important vibrating membrane decreases, and there is also a problem on which driving efficiency gets worse.

[0006]in these results, the cylindrical permanent magnet of a book opens many large intervals mutually -- not allocating -- it will be necessary to obtain, therefore to take the large interval of permanent magnet structure and vibrating membrane, and conversion efficiency worsens also at the point, and the whole electromagnetic transducer becomes thick.

[0007]in the Prior art, the composition which presses down vibrating membrane firmly with a spacer by a periphery was adopted -- a fulcrum will arise in a sake at a periphery, and it becomes vibration which carried out what is called "accretion accretion", and is hard to make a faithful reproduced sound to driving current, and the problem that amplitude moreover cannot be enlarged arises.

[0008]The purpose of this invention is to provide the electromagnetic transducer which cancels the fault of the above conventional technologies, is easy to manufacture, and is easy to slim down. While devising so that a big vibration amplitude can be taken, as other purposes of this invention control allophone (noise) generating by resonance by the periphery of vibrating membrane and vibrating membrane can vibrate locally, on the whole, and freely, It is providing the thin electromagnetic transducer with which a sound faithful to driving current was made to be outputted.

[0009]

[Means for Solving the Problem]This invention is a thin electromagnetic transducer possessing a permanent magnet plate, vibrating membrane arranged so that this permanent magnet plate may be countered, a buffer member which intervenes between this vibrating membrane and said permanent magnet plate, and a support member which regulates a relative position to a permanent magnet plate of said vibrating membrane. Said permanent magnet plate is making integral construction which parallel stripes-like multi-electrode magnetizing patterns in which a band-like n pole and the south pole appear by turns were formed almost in the whole surface of the vibrating membrane opposed face, and arranged many through holes for exhaust air in a position of a neutral zone in magnetizing patterns. Said vibrating membrane is the structure which carried out the printed wiring of the coil which becomes a thin flexible resin film from meandering (round trip)-shaped conductor patterns, Although these conductor patterns are provided in a position corresponding to a neutral zone of said permanent magnet plate in the straight-line portion and displacement of field inboard is regulated

by said support member, without being fixed in a periphery, it is supported by thickness direction so that it can be displaced freely. Said buffer member makes structure which was elasticity, and has breathability and accumulated two or more sheets of the almost same size as said vibrating membrane, and it is allocated so that it may have a crevice between this sheet, said permanent magnet plate, or vibrating membrane.

[0010]Although a permanent magnet plate and a buffer member may be allocated only in the one side side of vibrating membrane, they are the physical relationship that it arranges to both sides of this vibrating membrane, respectively so that vibrating membrane may be pinched, and each neutral zone is in agreement in both permanent magnet plates, and like poles face each other, and their composition which sets an interval and is fixed is desirable. In that case, it is not necessary to be necessarily a symmetrical structure to vibrating membrane. Therefore, the same raw material and identical shape may be sufficient as both permanent magnet plates, and they may be a different raw material and different shape (thickness). A sintered magnet may be sufficient as a permanent magnet plate, for example, and a plastic magnet, a metal magnet, etc. may be sufficient as it.

[0011]Conductor patterns of meandering (round trip) shape used as a coil may be formed only in one side of a resin film, and may be formed in both sides. Corresponding to a center line of each neutral zone of a permanent magnet plate, it may form one conductor patterns at a time, and two or more conductor patterns may be provided. To install two or more conductor patterns in one neutral zone side by side, it is necessary to distribute so that it may become completely symmetrical to a center line. Anyway, it is necessary to maintain physical relationship with parallel center line and conductor patterns.

[0012]As for a vibrating membrane opposed face of a permanent magnet plate, it is preferred to stick high-magnetic-permeability magnetic plates for prevention from a magnetic flux leak (for example, a griddle, a ferronickel alloy plate, etc.) to a field of an opposite hand. In that case, it is necessary to form the same through hole for exhaust air as the same position as a through hole for exhaust air formed in a permanent magnet plate, and it is necessary to constitute so that a sound wave generated inside may be smoothly emitted to the exterior.

[0013]

[Embodiment of the Invention]In the surface of the permanent magnet plate, a band-like n pole and south pole have appeared by turns in the shape of parallel stripes by magnetization. A vertical magnetic field component (absolute value) is [ near a n pole and the south pole ] the largest on the surface of a permanent magnet plate, and it becomes the smallest near the boundary of a n pole and the south pole. It is because this looks at and defines the ingredient of a magnetization field perpendicularly, and near the boundary of a n pole and the south pole, since there is no magnetic field of a vertical component, this field is called the neutral zone. When the horizontal component (ingredient parallel on the surface of a permanent magnet plate) of a magnetic field is seen to it, it is [ near a n pole and the south pole ] the smallest, and the largest near the boundary (neutral zone) of a n pole and the south pole. Even if it sees this from a line of magnetic force passing from an adjoining n pole circularly to the south pole, it is clear. The magnetic field component which contributes to vibrating vibrating membrane to a thickness direction is not a vertical component but a horizontal component (left-hand rule of Fleming). It is not near each pole but a position of a neutral zone which the horizontal component of this magnetic field commits most effectively as mentioned above. Then, when the straight-line portion of conductor patterns is provided in the position corresponding to a neutral zone, a line of magnetic force will pass in direction which crosses the straight-line portion of conductor patterns in the field of vibrating

membrane. Therefore, if driving current is supplied to a coil (conductor patterns) with such composition, electromagnetic force will occur most efficiently by the interaction of the current and magnetic field, and vibrating membrane will vibrate to a thickness direction. The sound wave generated by it will be emitted outside through the through hole for exhaust air formed in the permanent magnet plate (and high-magnetic-permeability magnetic plate). This is a sound production principle of the electromagnetic transducer concerning this invention, and the principle of this electromagnetism conversion itself is the same as that of this conventional kind of electromagnetic transducer.

[0014] One parallel stripes-like multi-electrode magnetizing patterns of the feature of this invention are formed in the surface all over almost, And it is really by which many through holes for exhaust air were arranged at the position of the neutral zone in magnetizing patterns a point using the permanent magnet plate of continuation structure (structure which is not the combination of an individual magnet) as a magnetic driving source. Other features of this invention are points currently supported so that it may not be fixed by a periphery but vibrating membrane can be freely displaced only to a thickness direction. Other features of this invention are the points of providing the buffer member of the structure which accumulated two or more sheets which are elasticity and have breathability so that it may have a crevice between a permanent magnet plate or vibrating membrane.

[0015]. [ whether a permanent magnet plate is a sintered magnet, or it is a non-sintering magnet or they are flexible magnets or it is a magnet of solid structure, and ] Or construction material (a ferrite magnet, a rare earth permanent magnet, a neodymium iron-boron system magnet, etc.), The characteristic etc. are arbitrary, and are design problems and thickness, shape (a square, a rectangle, circular, an ellipse form, etc.), and structures -- whether it is a permanent magnet plate of one sheet or it is the structure which pasted two or more permanent magnet plates together -- choose them suitably according to the characteristic, cost and manufacturing necessity, condition of use, etc. the size (size of magnetization) of a magnetic pole -- a pitch etc. are very arbitrary. There is composition which arranges a permanent magnet plate only in one side of vibrating membrane, and there is also composition arranged on both sides. On the contrary, the both sides of a permanent magnet plate also have the composition which arranges vibrating membrane so that a permanent magnet plate may be inserted. Conductor patterns may be provided in one side of the resin film of vibrating membrane, and may be provided in both sides. Vibrating membrane may consist of resin films of two or more sheets. It arranges so that it may correspond to the neutral zone in a permanent magnet plate, but one conductor patterns may be arranged to each neutral zone of each (1 turn composition), and it may arrange them two or more [ at a time ] (two or more turn composition).

[0016]

[Example] Drawing 1 is an explanatory view showing one example of the monotonous loudspeaker which is a kind of the thin electromagnetic transducer concerning this invention. In the figure, A shows an entire configuration, and B expands and (however, the graphic display of a buffer member abbreviation) shows the important section. This monotonous loudspeaker possesses the permanent magnet plate 10, the vibrating membrane 12 arranged so that this permanent magnet plate 10 may be countered, the buffer member 14 which intervenes between this vibrating membrane 12 and said permanent magnet plate 10, and the support member 16 which regulates the position over said permanent magnet plate 10 of said vibrating membrane 12. And the permanent magnet plate 10 and the buffer member 14 are symmetrically arranged to both sides of this vibrating membrane 12, respectively so that a thing of the same kind may sandwich the vibrating membrane 12.

[0017]The permanent magnet plate 10 is plate-like [ square ] here, as shown in drawing 2, The integral construction which consisted of a sintered ferrite magnet, and formed parallel stripes-like multi-electrode magnetizing patterns in which a band-like n pole and south pole appear by turns all over almost [ of the vibrating membrane opposed face ], and arranged many through holes 18 for exhaust air in the position of the neutral zone nz of magnetizing patterns is made. In the through hole 18 for exhaust air of the neutral zone nz which forms and adjoins at constant pitch along the neutral zone nz, the through hole 18 for exhaust air could be shifted half a pitch, and is arranged in the shape of a hound's-tooth check. Although it may arrange in the shape of [ which serves as the same position in an adjoining neutral zone ] a tetragonal lattice, it is more desirable to consider it as the shape of an above hound's-tooth check, since a hole interval becomes narrow and a possibility that the mechanical strength of a permanent magnet plate may fall and break will arise, if a magnetization pitch becomes small. Although the shape of the through hole 18 for exhaust air may be circular or an ellipse may be sufficient, size shape selects a suitable thing and arranges them precisely. It is because the sound wave generated inside will not fully be emitted outside if too small, the volume of the permanent magnet plate 10 will fall, an operation magnetic field will become weak, if too large, and a mechanical strength also falls.

[0018]Such a permanent magnet plate 10 can be easily manufactured by carrying out laminate integration of the unsintered multi-hole magnet sheet, and sintering it, for example. Multi-electrode magnetization uses the magnetization jig of the structure which embedded the electric wire at each striation of the magnetization yoke which engraved many striations in parallel, sticks this magnetization jig and a permanent magnet plate, and can form parallel stripes-like multi-electrode magnetizing patterns in which a magnetic pole appears in band-like on the surface of a permanent magnet plate by supplying pulse current. In this case, the portion which countered the striation serves as a neutral zone.

[0019]As shown in drawing 2, said vibrating membrane 12, For example, the coil 22 which becomes about 30 micrometers in thickness, a biaxial-stretching polyethylene terephthalate film not more than it (trade name: miler), or the thin flexible resin film 20 like an aromatic polyimide film (trade name: Kapton) from the conductor patterns of meandering shape. It is the structure which carried out printed wiring. Although displacement of field inboard is regulated by said support member 16, without providing the straight-line portion in a neutral zone and parallel, and fixing it to the position corresponding to the neutral zone nz of said permanent magnet plate 10 thoroughly by a periphery, this coil 22, It is supported by the thickness direction so that it can be displaced freely.

[0020]Return to drawing 1 and the structure which said buffer member 14 was elasticity, and has breathability (a sound wave can pass freely) and accumulated two or more sheets 24 of the almost same size as the vibrating membrane 12 is made, It is provided so that it may have this sheet 24, said permanent magnet plate 10, or a crevice suitable between the vibrating membrane 12. As said sheet 24, a thin nonwoven fabric is preferred, and where about (2-5 sheets) three sheets are piled up, it infixes, for example. It has not pasted up in piles and "the state where it piled up" means here the state where it has only lapped in the sparse state so that it can vibrate separately, respectively (displacement). The thickness of a nonwoven fabric, construction material, and the number of sheets to pile up are changed according to a design condition etc. This buffer member 14 bears the operation which controls suitably generating of those other than a sound wave faithful to a sound source, such as preventing whether the vibrating membrane 12 strikes to the permanent magnet plate 10 at the time of operation, and emitting an allophone (noise which is not a normal vibration sound), and



preventing generating of vibrating membrane's own partial vibration (generating of a chatter sound is prevented). Although the buffer member 14 which consists of nonwoven fabrics is drawn with the dashed line in A of drawing 1, the sheet of the almost same size as vibrating membrane is accumulated as aforementioned.

[0021]Both permanent magnet plates 10 are held by the support member 16. The support member 16 consists of combination of the bearing bar 26 provided in four corners here, and the nut 28 screwed at the both ends. Between permanent magnet plate 10 comrades of two sheets, it fixes mechanically firmly so that an interval may be set and fixed physical relationship may be maintained by these support member 16. The vibrating membrane 12 located in between drills the hole 13 (refer to drawing 2) in four corners, said bearing bar 26 is made to insert in the hole 13, and although the position regulating of field inboard is made by fitting in the accuracy of micron order, this vibrating membrane 12 is constituted by it to the thickness direction so that it can be displaced freely. If the vibrating membrane 12 is displaced in a transverse direction and shifts from the magnetizing patterns of the permanent magnet plate 10, since it will become that it is hard to generate a sound wave efficiently, it supports so that a coil straight-line portion may not separate from a neutral zone. The composition which establishes a hole in a corner similarly, and inserts in and supports said bearing bar 26 may be sufficient also as the nonwoven fabric which is a buffer member. Anyway, it is necessary to enable it to be freely displaced to a thickness direction like vibrating membrane.

[0022]In this example, with the vibrating membrane opposed face of the permanent magnet plate 10, the high-magnetic-permeability magnetic plate 30 for the prevention from a magnetic flux leak is stuck to an opposite side, and the through hole 18 for exhaust air formed also in this high-magnetic-permeability magnetic plate 30 at the permanent magnet plate 10 and the same through hole 32 for exhaust air are formed in the same position so that it may be open for free passage. As the high-magnetic-permeability magnetic plate 30, a griddle, a ferronickel alloy (permalloy) board, etc. are preferred, for example.

[0023]In the above composition, in the surface (vibrating membrane opposed face) of the permanent magnet plate 10, a band-like n pole and south pole appear by turns, and it has become parallel stripes-like magnetizing patterns. And since the straight-line portion of the coil 22 of the vibrating membrane 12 is provided in the position corresponding to a neutral zone (boundary line of a n pole and the south pole), a line of magnetic force will pass in direction which crosses the straight-line portion of the coil 22 in the field of the vibrating membrane 12 (an arrow shows the example of a line of magnetic force to B of drawing 1). Therefore, if driving current is supplied to the coil 22, electromagnetic force will occur in a thickness direction by the interaction of the current and magnetic field, and the vibrating membrane 12 will vibrate. The sound wave generated by this vibration will be emitted outside through the through holes 18 and 32 for exhaust air formed in the permanent magnet plate 10 and the high-magnetic-permeability magnetic plate 30.

[0024]With the electromagnetic transducer concerning this invention, it is thought that a sound wave is generated, respectively from the part (infinitesimal area of the straight-line portion of the coil 22) of the vibrating membrane 12. That is, since it is in the free state where the vibrating membrane 12 does not adhere thoroughly in the periphery (edge part), but it can be displaced to a thickness direction, When driving current flows into the coil 22, the vibrating membrane 12 will vibrate freely locally according to the electromagnetic force which follows the left-hand rule of Fleming in the partial portion. The composite vibration by which these local vibration was compounded reaches a listener's ear, and is recognized as a sound. In the free state, such a local vibration is made not to be barred also [ near the circumference ], a faithful alteration in percussion

sound is made to perform, and the peripheral part is supported in order to raise the generating efficiency of a sound wave as the whole device.

[0025]In the permanent magnet plate 10, a line of magnetic force arises to the south pole which adjoins from the arbitrary n poles of the surface. As mentioned above, although the vertical component of a magnetic field is [ near a n pole and the south pole ] the largest, it is the smallest near the boundary of a n pole and the south pole. The horizontal component of a magnetic field is [ near a n pole and the south pole ] the smallest to it, and it is the largest near the boundary of a n pole and the south pole. In the case of the permanent magnet plate of one sheet, a line of magnetic force is mostly produced in concentric circle shape. However, since both permanent magnet plates have become as [ counter / a like pole ] (a n pole and a n pole face each other, and the south pole and the south pole face each other) case [ like the above-mentioned example which carried out the placed opposite of the permanent magnet plate of two sheets ], As shown in B of drawing 1, the line of magnetic force which goes to the south pole from the n pole of one permanent magnet plate, and the line of magnetic force which goes to the south pole from the n pole of the permanent magnet plate of another side push one another, and it changes so that it may balance by a center portion and a horizontal (direction passing through the inside of the field of the vibrating membrane 12) ingredient may increase. In order that this horizontal ingredient may contribute to generating of a sound wave, when especially the placed opposite of such a permanent magnet plate considers a coil as two or more turn composition, since conductor-patterns region disposing can be increased (when letting two or more conductor patterns pass to one neutral zone), it is desirable. Of course, electromagnetism conversion efficiency also becomes high.

[0026]The conductor patterns used as a coil can also have two or more turn composition besides 1 simple turn composition as shown in drawing 2. The example of 2 turns is shown in drawing 3. The coil 22 with which two conductor patterns were provided at a time in parallel is formed in the surface of the resin film 20. To the center line of a neutral zone, by right-and-left distribution, in turn composition, it brings close as much as possible (it becomes symmetrical like), and more than one are arranged to it. The relation between the coil 22 in 2 turns and the magnetic pole of the permanent magnet plate 10 is shown in drawing 4. By using such a relation, the vibration by the ingredient of power parallel to a field produced with the conductor patterns of a position which separated from the center line of the neutral zone can be offset, and vibrating membrane can be vibrated as much as possible in the efficient direction vertical to a field.

[0027]As shown in A of drawing 5, the composition which forms the coil 22 in one side of the resin film 20 may be sufficient as vibrating membrane, and the composition which forms the coil 22 in both sides of the resin film 20 may be sufficient as it (refer to B of drawing 5). As shown in C of drawing 5 depending on the case, the composition which is repeated two or more sheets by turning up the resin film 20 to which the coil 22 was attached, and is arranged is also possible. However, to pile up the resin film in which the coil was formed to both sides, it is necessary to make another insulating film intervene in between, or to cope with performing an insulation process to a coil surface etc.

[0028]Drawing 6 is an explanatory view showing other examples of the thin electromagnetic transducer concerning this invention. The example shown in A of drawing 6 is an one side drive type of a permanent magnet plate. The permanent magnet plate 10 is arranged via the buffer member 14 which becomes one side (a figure under) of the vibrating membrane 12 from the nonwoven fabric of two or more sheets, the multi-hole presser-foot board 60 is arranged via the buffer member 14 which consists of a nonwoven fabric of two or more sheets in an opposite hand (a figure on), and four corners are fixed by the support member 16. In

drawing 6, in order to make a drawing intelligible, most buffer members 14 are omitted and it has drawn, but it is the almost same size as vibrating membrane actually. It cannot be overemphasized that it is not fixed around but can be freely displaced as a whole now by the vibrating membrane 12 and the buffer member 14 to a sliding direction here. Although not illustrated, it is good to form a high-magnetic-permeability magnetic plate in the undersurface side of the permanent magnet plate 10.

[0029]There are other various applications in this invention. For example, when giving multi-electrode magnetization to both sides of a permanent magnet plate, as shown in B of drawing 6, it is also possible to have composition which arranges the vibrating membrane 12 on both sides of the permanent magnet plate 70. That is, between the permanent magnet plate 70 and the vibrating membrane 12 and between the vibrating membrane 12 and the multi-hole presser-foot board 60, the buffer member 14 is arranged, respectively and it fixes by the support member 16 in a corner. Although the fixed method is the same as that of each above-mentioned example, it presses down with the permanent magnet plate 70 and the board 60 is fixed, the vibrating membrane 12 and the buffer member 14 enable it to be freely displaced in a thickness direction. As shown in C of drawing 6, it is also possible to replace with this multi-hole presser-foot board, and to have composition which forms another permanent magnet plate 10.

[0030]Although the sound pressure which generates the composition shown in A of drawing 6 since the number of permanent magnet plates is one sufficient is small, it is a short form.

There is an advantage which can carry out lightweight slimming down.

In the composition of B of drawing 6, both vibrating membrane can be driven simultaneously. In C of drawing 6, although it becomes a thick type a little, sound pressure to generate can be enlarged.

[0031]It is [ permanent magnet plate / which is used by this invention ] usable in arbitrary permanent magnet plates besides a sintered ferrite magnet which was described in the above-mentioned example. For example, a rare earth system permanent magnet may be sufficient, and a neodymium iron-boron (Nd-Fe-B) system permanent magnet and other metal system magnets may be used. Sintering or a solid permanent magnet may be sufficient, and the plastic magnet hardened by resin may be used. In the composition which arranges two or more permanent magnet plates, the permanent magnet plate with which kinds differ may be combined. For example, the composition of using a sintered magnet for the main portions and using a plastic magnet for a substitute's portion is also possible. It may constitute from pasting together the permanent magnet plate with which two or more kinds differ one permanent magnet plate.

[0032]the shape of a permanent magnet plate -- in other words, a round shape, an ellipse form besides square-shaped structures, such as a square and a rectangle, etc. may be sufficient as the shape of an electromagnetic transducer. Of course, in addition, arbitrary shape may be sufficient. Since it has a thin shape, not only flat plate shape but the thing to consider as arbitrary curved surface shape (for example, curving surface shape which bulged, crooked corrugated surface shape, etc.) is possible. The whole thickness is suitably determined according to structure, condition of use or a military requirement, etc. the size (size of magnetization) of each pole in band-like parallel magnetizing patterns -- what is necessary is just to determine a pitch suitably according to condition of use, a military requirement, etc. similarly very much

[0033]Single sheet constitution may be sufficient as vibrating membrane as mentioned above, and the composition repeated two or more sheets may be sufficient as it. Usually, photo etching of the flexible copper-clad print film is carried out, and the vibrating membrane which has a desired coil pattern is produced. One turn composition may be sufficient as the coil currently united with the resin sheet by such printed wiring art,

and two or more turn composition may be sufficient as it. The composition which forms a coil in up-and-down both sides of a resin sheet may be used. In that case, it is possible to connect between the electric conduction patterns of the upper and lower sides by the art of a through hole etc. The sectional shape of conductor patterns, construction material, length used as a coil, etc. are deduced from the design impedance of a loudspeaker, etc., and are determined.

[0034]

[Effect of the Invention] Since this invention really uses the multi-electrode magnetization permanent magnet plate of composition as mentioned above, it can be easily highly precise, can be manufactured and can give sufficient mechanical strength. Fine magnetizing patterns can also be formed with high degree of accuracy. Since it appears only in a vibrating membrane opposed face, in the unnecessary direction, it is hard to pass along a line of magnetic force, the number of the lines of magnetic force interlinked with the coil of important vibrating membrane increases, and driving efficiency of a magnetic pole also improves. Since magnetizing patterns can be formed densely, the interval of permanent magnet structure and vibrating membrane can be narrowed, conversion efficiency improves also at the point and the whole electromagnetic transducer can be made thin.

[0035] Since vibrating membrane is supported in this invention so that it can be freely displaced in a thickness direction by a periphery, a fulcrum is not produced in a periphery, but a faithful reproduced sound is made to driving current, and there is an advantage which can moreover enlarge amplitude. Since the buffer member which consists of nonwoven fabrics etc. intervenes between vibrating membrane and a permanent magnet body, vibrating membrane does not collide with a permanent magnet body etc., and generating of unnecessary noises (BIBIRI sound etc.) can be prevented.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The explanatory view showing one example of the electromagnetic transducer concerning this invention.

[Drawing 2]The perspective view showing a permanent magnet plate, the structure of vibrating membrane, and mutual position relations.

[Drawing 3]The explanatory view showing other examples of vibrating membrane.

[Drawing 4]The explanatory view showing a permanent magnet plate, the structure of vibrating membrane, and mutual position relations.

[Drawing 5]The explanatory view showing other examples of vibrating membrane.

[Drawing 6]The explanatory view showing other examples of composition of the electromagnetic transducer concerning this invention.

[Description of Notations]

10 Permanent magnet plate

12 Vibrating membrane

14 Buffer member

16 Support member

20 Resin film

22 Coil

30 High-magnetic-permeability magnetic plate

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[Translation done.]

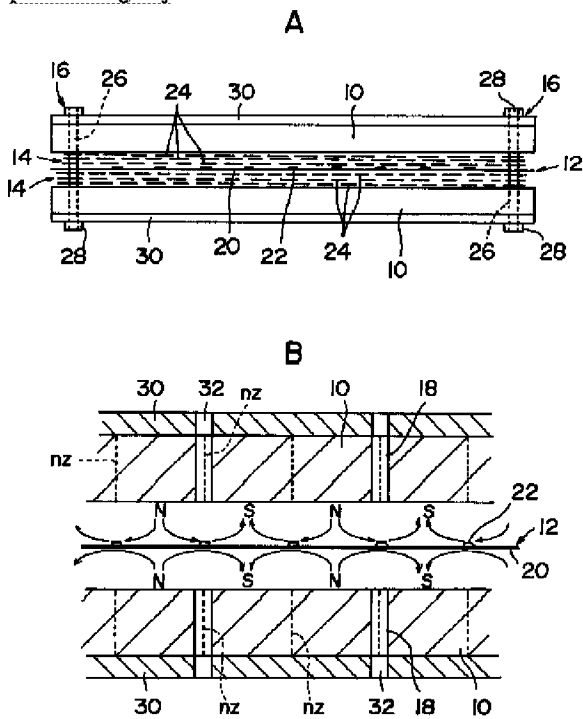
\* NOTICES \*

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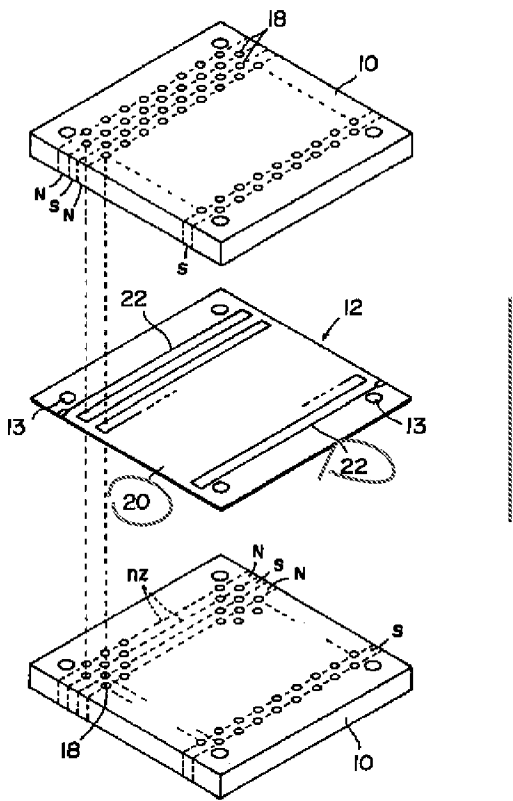
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DRAWINGS

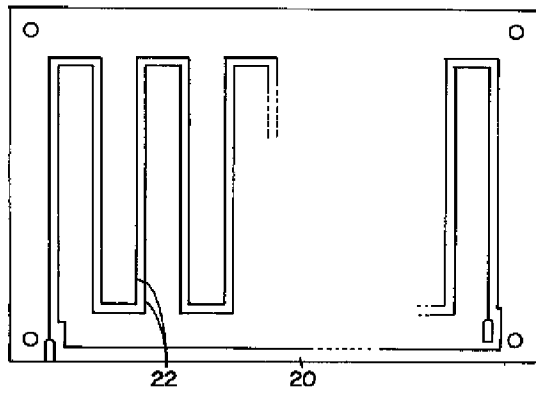
[Drawing 1]



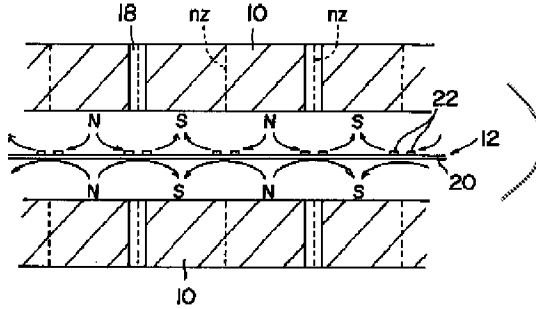
[Drawing 2]



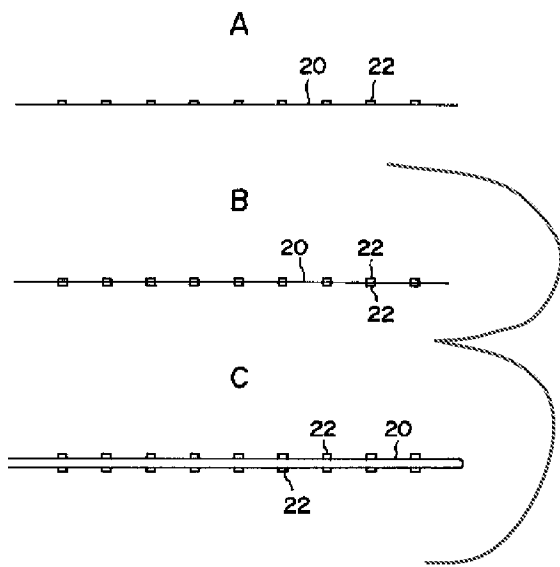
[Drawing 3]



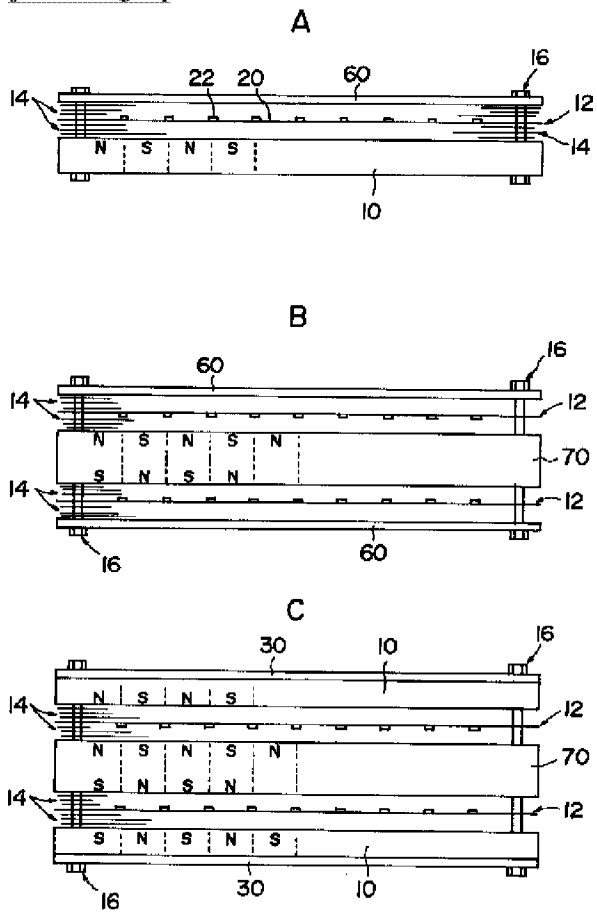
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]